Regulation of Modernizing Power Distributors: Lessons From Research on Performance-Based Regulation

Mark Newton Lowry

Pacific Economics Group Research, LLC

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Introduction

This presentation discusses the regulatory context for distribution system planning

Traditional cost of service regulation (COSR) is problematic for distributors engaged in accelerated grid modernization

State engagement in distribution system planning is warranted

Performance-Based Regulation (PBR) of distributor services may be a sensible complement

This presentation considers lessons for power distributor regulation of my recent PBR research for Berkeley Lab, *State Performance-Based Regulation Using Multiyear Rate Plans for U.S. Electric Utilities*

Cost of Service Regulation

COSR Basics

- Base rates adjusted in rate cases that are often irregularly timed
- Tracker/rider treatment of energy expenses
- Usage (e.g., volumetric and demand) charges collect many “fixed” costs

Sensitivity to Business Conditions

- Utility performance and regulatory cost vary with business conditions (e.g., inflation and average use trends)
- When conditions are *favorable* to utilities, rate cases are infrequent so regulatory cost is low and performance incentives are strong
- When conditions are *chronically unfavorable*, rate cases are frequent. Regulatory cost is high, performance incentives are weakened, and operating flexibility is restricted
- Performance can deteriorate just when good performance is crucial

Indicators of Electric Utility Financial Attrition

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	Average Annual Electricity Use					GDPPI Inflation[2]		Summary Attrition Indicator
	Residential[1]		Commercial[1]		Average			
	Level	Growth Rate	Level	Growth Rate	Growth Rate	Level	Growth Rate	
Multiyear Averages					[A]		[C]	[C]-[A]
1931-1940	723	5.45%	4,048	2.00%	3.73%	7.99	-1.59%	-5.31%
1941-1950	1,304	6.48%	6,485	5.08%	5.78%	11.37	5.26%	-0.52%
1951-1960	2,836	7.53%	12,062	6.29%	6.91%	16.04	2.42%	-4.49%
1961-1972	5,603	5.79%	31,230	8.79%	7.29%	20.35	2.98%	-4.32%
1973-1980	8,394	2.03%	50,576	2.53%	2.28%	34.74	7.18%	4.90%
1981-1986	8,820	0.12%	54,144	0.81%	0.46%	54.22	4.57%	4.11%
1987-1990	9,424	1.39%	60,211	2.29%	1.84%	63.32	3.33%	1.49%
1991-2000	10,061	1.15%	67,006	1.68%	1.41%	75.70	2.03%	0.62%
2001-2007	10,941	0.73%	74,224	0.64%	0.68%	89.83	2.47%	1.79%
2008-2014	11,059	-0.38%	75,311	-0.22%	-0.30%	103.53	1.60%	1.90%

[1] U.S. Department of Energy, Energy Information Administration, Form EIA-861, "Annual Electric Utility Report," and Form EIA-826, "Monthly Electric Utility Sales and Revenues Report with State Distributions," and EIA-0035, "Monthly Energy Review."

[2] Bureau of Economic Analysis, Table 1.4.4. Price Indexes for Gross Domestic Product, Gross Domestic Purchases, and Final Sales to Domestic Purchasers, Revised October 28, 2016.

>>> Key business conditions today are much less favorable than in COSR's "golden age" when it became a tradition

Capex Requirements

Many utilities today seek sustained high distribution capex

- Replace aging facilities
- Improve reliability and resiliency
- Improve system capabilities

This capex doesn't automatically trigger new revenue

Attrition impact greatest for utility distribution companies (UDCs)

COSR Today

UDCs engaged in accelerated modernization can request frequent rate cases or capital cost trackers. Under a 1-3 year rate case cycle…

Little profit from capex containment

Rate base growth main path to earnings growth

Weak incentive to embrace demand side management (DSM) and distributed generation and storage (DGS)

- Declining average use reduces margins between rate cases
- Less rate base growth
- Rate designs that encourage efficient DSM and DGS are risky
- Tracking of many load-related (e.g., energy procurement, line loss, and transmission) costs weakens incentive to contain them

>>> Weak performance incentives while competition mounts

COSR Today (cont'd)

Review of capex prudence is challenging in era of rapid technical change and shifting demand for distributor services

>>> weak incentives + prudence concerns
= need for distribution system planning

Rate cases divert regulatory resources from other worthwhile activities (e.g., generic proceedings on rate design, distribution system planning)

New Regulatory Frameworks

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COSR problems have spurred utilities to adopt alternative forms of regulation (Altreg)

Targeted Remedies

- Cost Trackers*
- Revenue Decoupling*
- Targeted Performance Incentive Mechanisms (PIMs)

Comprehensive Remedies

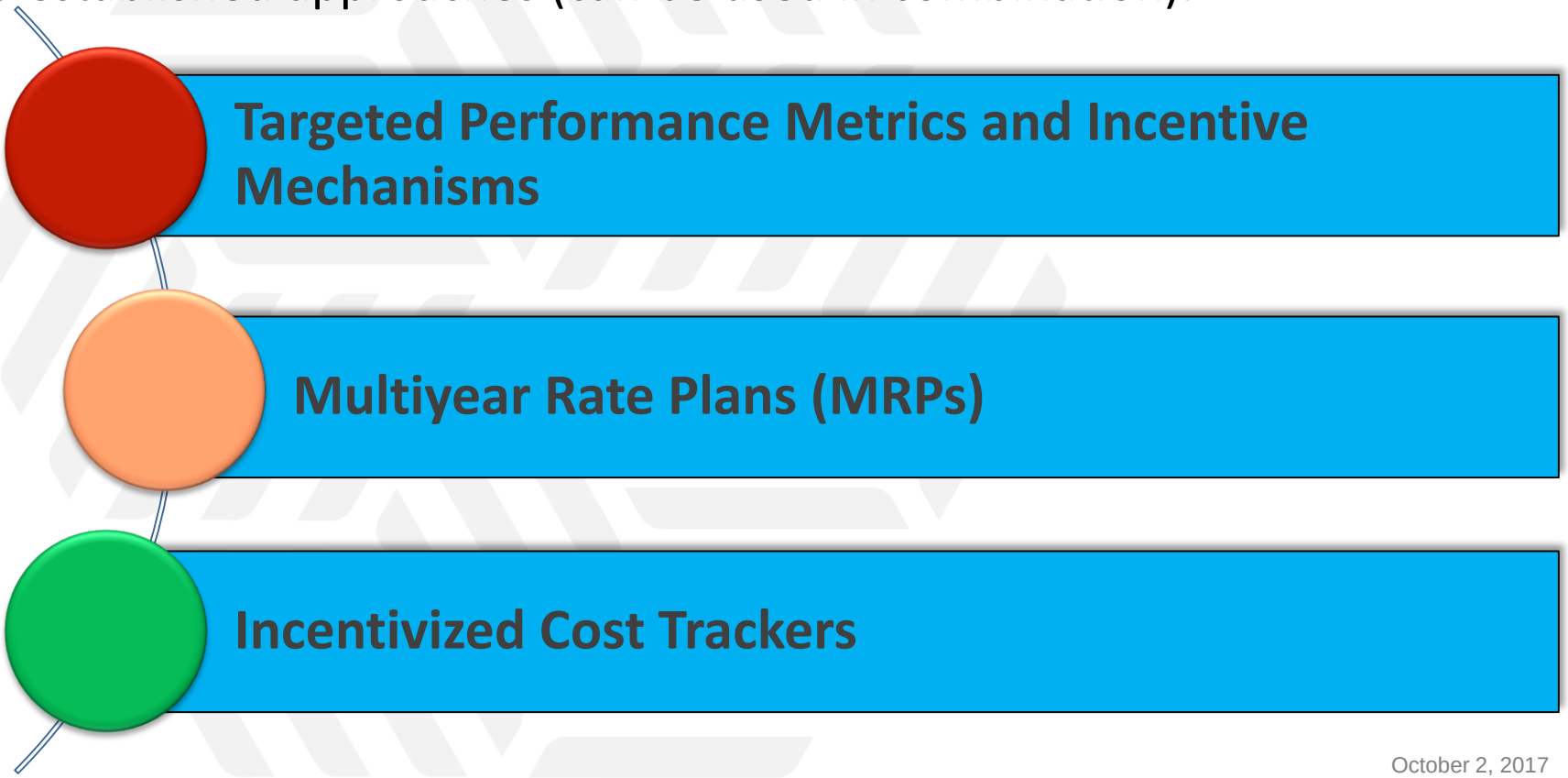
- Formula Rate Plans*
- Multiyear Rate Plans (MRPs)

*Precedents for these Altreg approaches detailed in Additional Slides

Performance-Based Regulation

PBR: Regulation designed to improve utility performance with stronger incentives

3 established approaches (can be used in combination):



Performance Metrics

Performance metrics quantify utility activities in key performance areas

Several potential uses

- Monitoring Only
- Monitoring with Target
- Performance Incentive Mechanisms (PIMs)

PIMs strengthen incentives in targeted areas by linking revenue to performance

Performance metric systems can have different approaches for different metrics

"Scorecards" summarize utility performance for public

What do PIMs Target?

PIMs most commonly target service quality and energy efficiency

Need for *new* performance metrics and incentive mechanisms is focus of recent "utility of the future" proceedings

Peak load management

- *System* load peak
- Non-wire alternatives to *local* grid investments

Utilization of advanced metering infrastructure capabilities

Quality of service to DGS customers

MRP practitioners (e.g., Britain, New York, Ontario) are also PIM innovators

Ontario Scorecard Metrics

Performance Outcomes	Performance Categories	Measures
Customer Focus Services are provided in a manner that responds to identified customer preferences.	Service Quality	New Residential/Small Business Services Connected on Time
		Scheduled Appointments Met On Time
		Telephone Calls Answered On Time
	Customer Satisfaction	First Contact Resolution
		Billing Accuracy
		Customer Satisfaction Survey Results
Operational Effectiveness Continuous improvement in productivity and cost performance is achieved; and distributors deliver on system reliability and quality objectives.	Safety	Level of Public awareness [measure to be determined]
		Level of Compliance with Ontario Regulation 22/04
		Serious Electrical Incident Index: Number of General Public Incidents
		Serious Electrical Incident Index: Rate per 10, 100, 1000 km of line
	System Reliability	Average Number of Hours that Power to a Customer is Interrupted
		Average Number of Times that Power to a Customer is Interrupted
	Asset Management	Distribution System Plan Implementation Progress
	Cost Control	Efficiency Assessment
		Total Cost per Customer [1]
		Total Cost per Km of Line [1]

Notes:
1. These figures were generated by the Board based on the total cost benchmarking analysis conducted by Pacific Economics Group Research, LLC and based on the distributor's annual reported information.
2. The Conservation & Demand Management net annual peak demand savings include any persisting peak demand savings from the previous years.

Ontario Scorecard Categories (continued)

Performance Outcomes	Performance Categories	Measures	
Public Policy Responsiveness Distributors deliver on obligations mandated by government (e.g., in legislation and in regulatory requirements imposed further to Ministerial directives to the Board).	Conservation & Demand Management	Net Annual Peak Demand Savings (Percent of target achieved) [2]	
		Net Cumulative Energy Savings (Percent of target achieved)	
	Connection of Renewable Generation	Renewable Generation Connection Impact Assessments Completed On Time	
		New Micro-embedded Generation Facilities Connected On Time	
Financial Performance Financial viability is maintained; and savings from operational effectiveness are sustainable.	Financial Ratios	Liquidity: Current Ratio (Current Assets/Current Liabilities)	
		Leverage: Total Debt (includes short-term and long-term debt) to Equity Ratio	
		Profitability: Regulatory Return on Equity	Deemed (included in rates)
			Achieved

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Multiyear Rate Plans

Key Components

- Reduced rate case frequency (e.g., 4-10 year cycle)
- Attrition relief mechanism (ARM) provides automatic relief for cost pressures *based on forecast or business condition index with a productivity growth commitment — not a cost tracker or "formula rate"*
- Trackers for some costs (e.g., energy)
- PIMs link earnings to reliability and customer service quality

Optional Components

- Revenue decoupling*
- Earnings sharing and off-ramp mechanisms
- Marketing flexibility (e.g., optional rates and services)*
- Additional PIMs (e.g., demand-side management)
- Integrated resource and distribution system planning

* Marketing flexibility discussed further in Additional Slides

MRP Rationale

Streamlined regulation

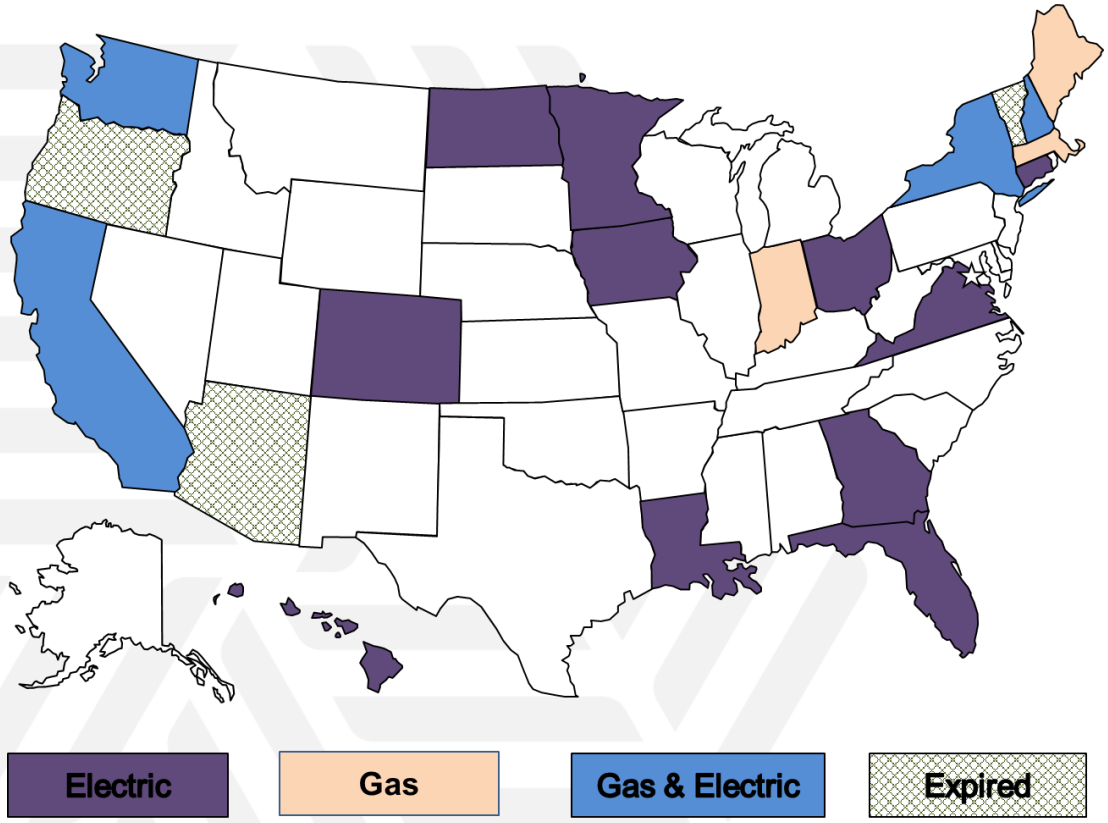
Fewer, less overlapping rate cases free resources for other uses (e.g., distribution system planning)

Stronger performance incentives

Fourth "leg" for the DSM (and DGS) "stool"

1) Revenue decoupling
2) Tracking of DSM Expenses
3) DSM (and DGS) Performance Incentive Mechanisms
4) MRP strengthens incentive to use DSM (and DGS) to cut costs (e.g., time-varying pricing)

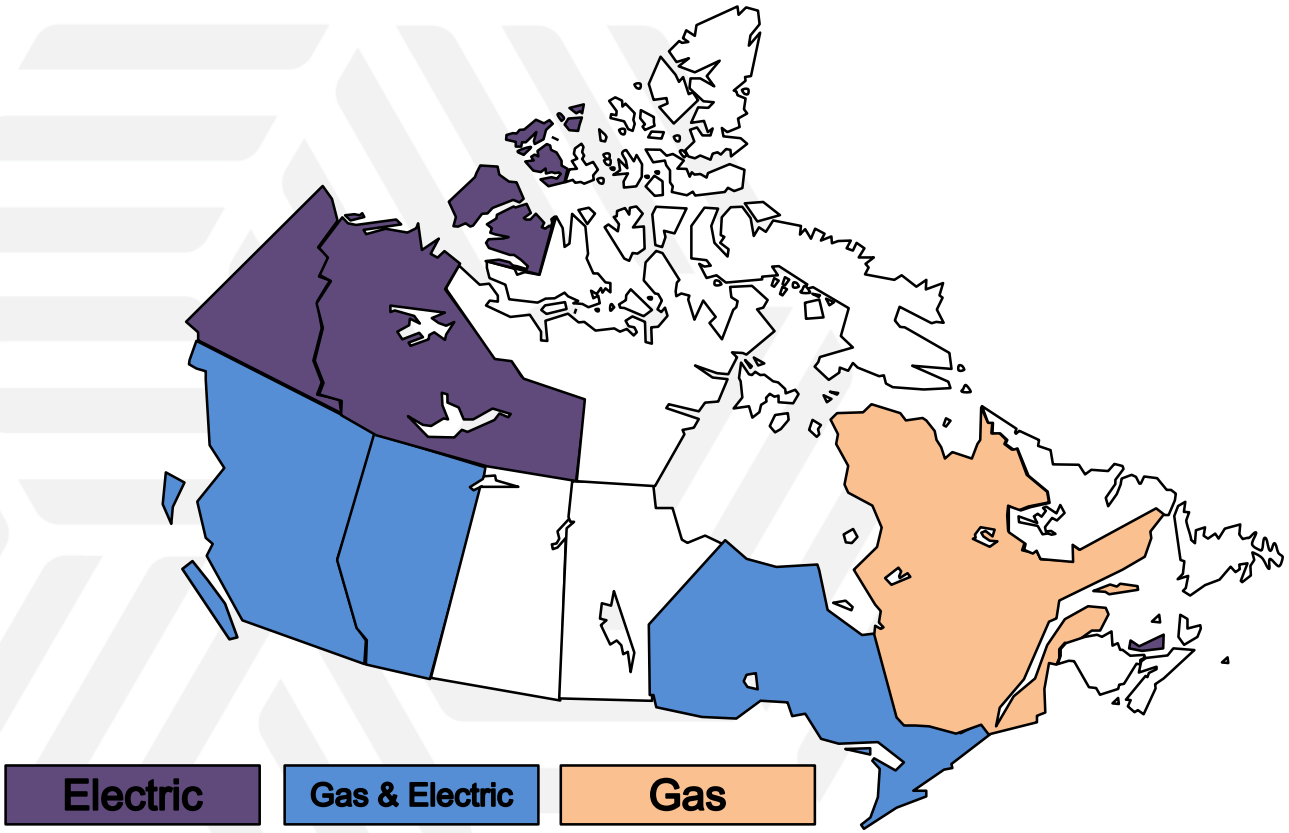
MRP Precedents: United States



MRPs are common form of Altreg in U.S.

Use of MRPs growing most rapidly for VIEUs

MRP Precedents: Canada



MRPs mandatory for distributors in populous Canadian provinces and many countries overseas (e.g., Australia and RIIO in Great Britain)

ARM Design

ARM design key issue in MRP proceedings

Several well-established approaches

- Indexing

  e.g. growth Revenue = growth Input Prices – X + growth Customers

  X Factor = Industry Productivity Trend + Stretch Factor

  Stretch factor sometimes based on statistical benchmarking

- Forecasting

- Hybrid

Measuring Productivity

Productivity index measures utility efficiency in converting inputs (e.g., labor, materials and capital) to outputs

Productivity grows when real (inflation-adjusted) cost grows more slowly than operating scale

Berkeley Lab paper reports productivity trends of U.S. power distributors; here are 2015-16 updates.*

	Average Annual Growth Rate (1996-2016)		
	Capital	O&M	Multi-factor
New England	0.14%	0.17%	0.09%
Broader Northeast	0.54%	0.16%	0.31%
Full U.S. Sample	0.35%	0.64%	0.43%

* Results for individual New England utilities in Additional Slides

Ontario Energy Board Uses Econometric Benchmarking to Set Stretch Factors

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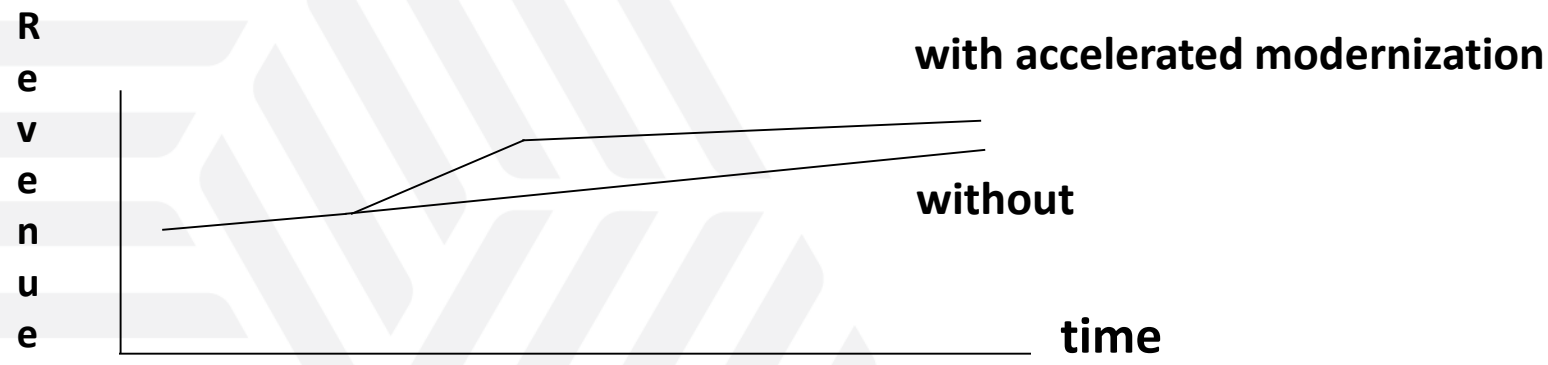
VARIABLE KEY

Input Price:	WK =	Capital Price Index
Outputs:	N =	Number of Customers
	C =	System Capacity Peak Demand
	D =	Retail Deliveries
Other Business Conditions:	L =	Average Line Length (km)
	NG =	% of 2012 Customers added in the last 10 years
	Trend =	Time Trend

EXPLANATORY VARIABLE	ESTIMATED COEFFICIENT	T-STATISTIC
WK*	0.6271	85.5530
N*	0.4444	8.0730
C*	0.1612	3.2140
D*	0.1047	3.4010
L*	0.2853	13.9090
NG*	0.0165	2.4110
Trend*	0.0171	12.5700
Constant*	12.815	683.362
System Rbar-Squared	0.983	
Sample Period	2002-2012	
Number of Observations	802	

***Variable is significant at 95% confidence level**

ARM Design (cont'd)



Agreeing on ARMs for *rapidly modernizing* UDCs is difficult

This has slowed growth of MRPs in U.S. energy distributor regulation

Some regulators (e.g., Alberta, Ontario, Britain) have grappled with issue

Typical treatments: forecasted ARM or indexed ARM + capital cost tracker

British regulators have struggled with utility cost forecasts

ARM Design and System Planning

Distribution system planning can inform design of ARMs

Enhances understanding of needed cost growth

Statistical cost (e.g., productivity and benchmarking) research can inform distribution system planning

- Identify cost inefficiency
- Measure system age
- Study cost trajectories of older systems
  - Accelerated modernization slows productivity growth
  - But productivity growth should rebound
  - Utilities should plan to achieve long run productivity trend of peers
- Study impact of smart grid on O&M expenses
- Index O&M expenses (e.g. Australia)
- British regulators use benchmarking (and independent engineering assessments) to make cost forecasts
- Ontario requires use of benchmarking and productivity research in utility cost forecasting; forward test year costs are benchmarked in rate cases

Case Study: Central Maine Power

Impetus for MRPs in Maine came from Commission
3 successive plans (here is the last)

Attrition Relief Mechanism:
growth Rates = growth GDPPI – X (X=1%)

Capital Cost Tracker: Automated metering infrastructure

Earning Sharing: Asymmetric sharing of surplus earnings

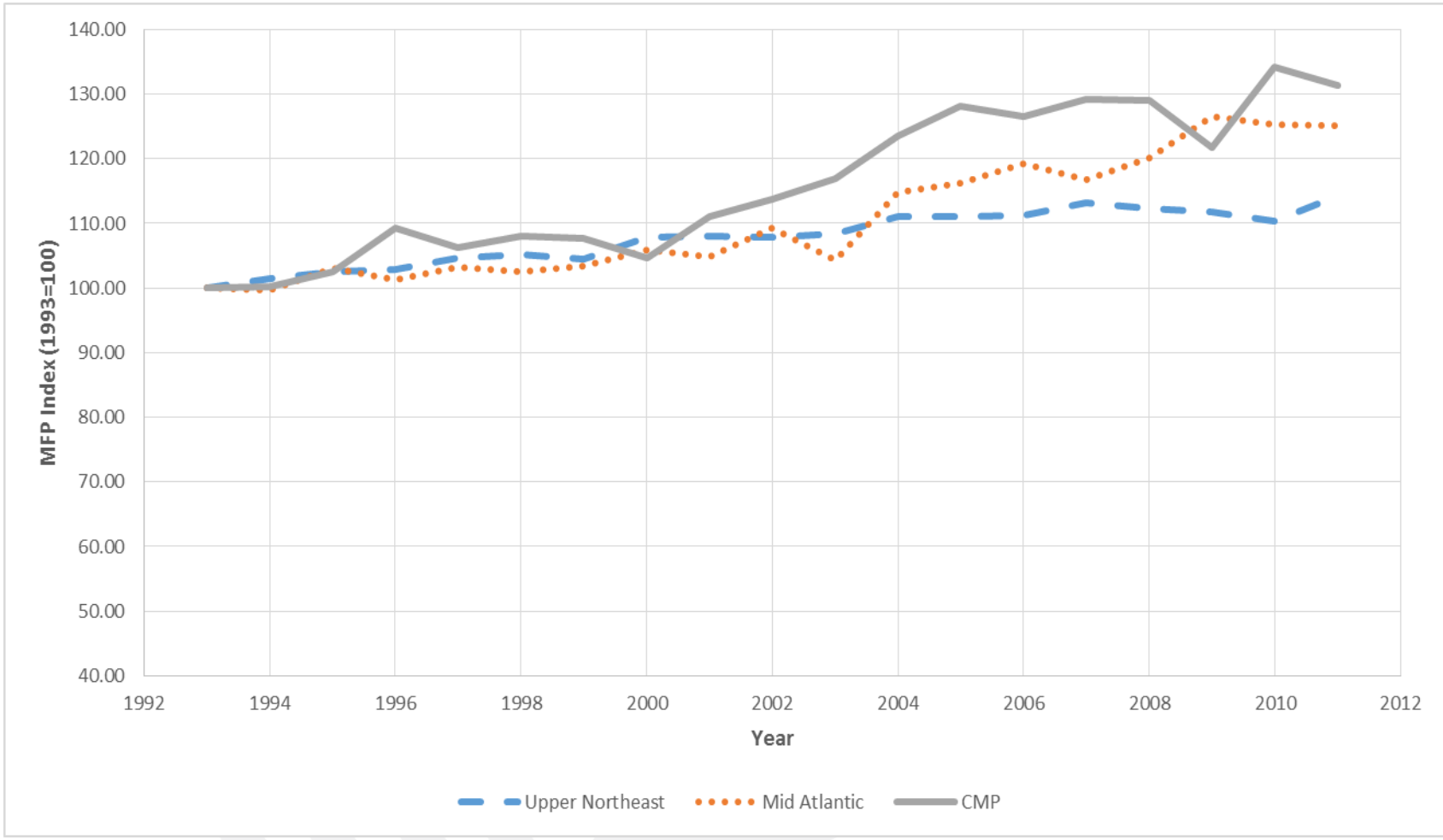
Plan term: 5 years (2009-2013)

Service Quality: Multi-indicator penalty mechanism

Marketing Flexibility: Light-handed regulation of optional rate schedules and rate discounts

Reference: Maine Public Utilities Commission, "ARP 2008 Settlement," June 2008

Distribution Productivity Trends of CMP and Two Northeast Regions*



*Productivity trends of other New England power distributors reported in Additional Slides

Conclusions

Accelerated distribution system modernization weakens performance incentives and raises regulatory cost under COSR

State engagement in distribution system planning needed

Expansive cost trackers and formula rates are dubious alternatives

PBR can complement distribution system planning

- Stronger incentives reduce prudence concerns
- Streamlined regulation can free resources for planning
- MRP design tools like productivity and benchmarking research can aid planning
- Planning facilitates MRP design

Additional Slides

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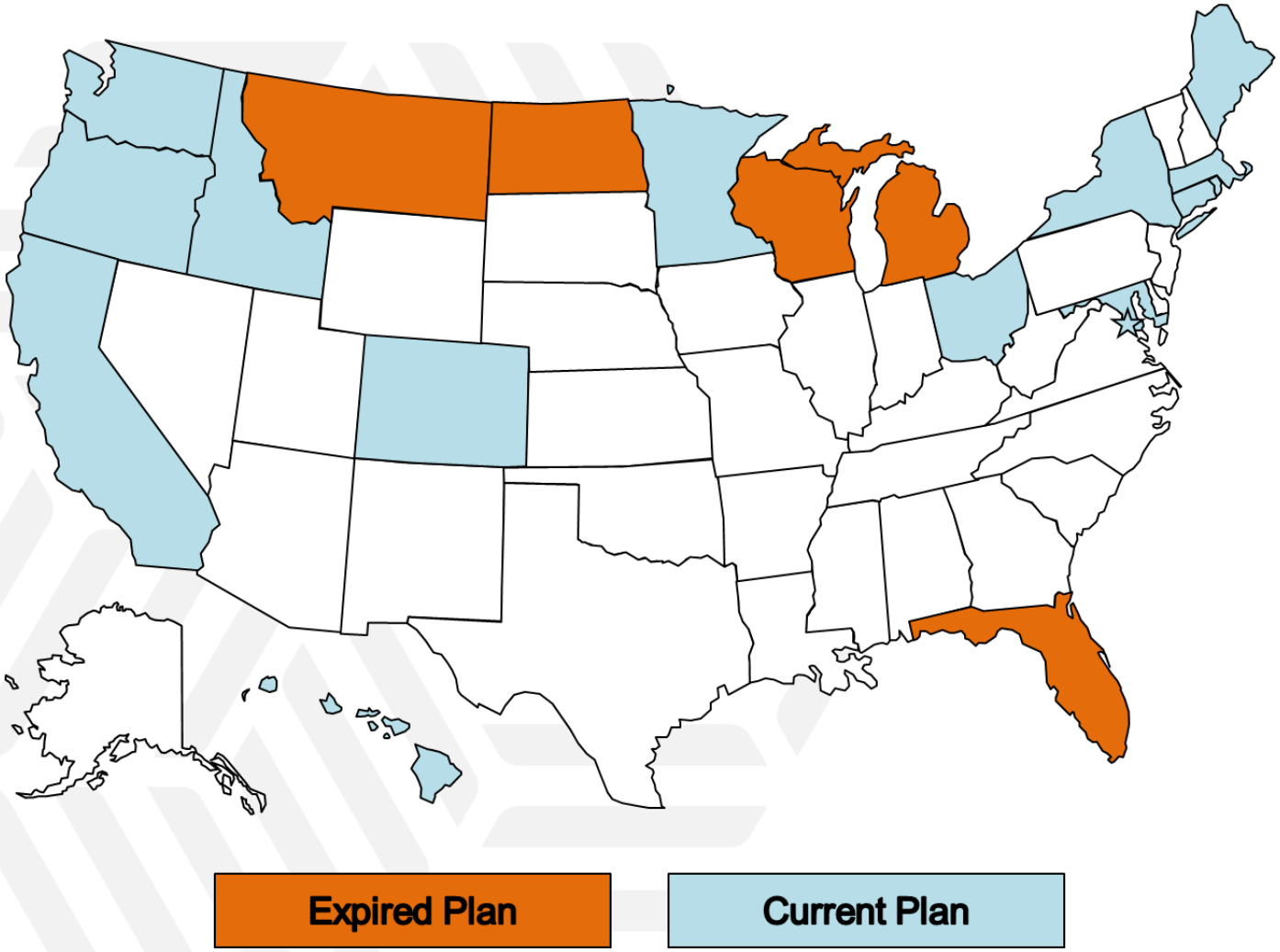
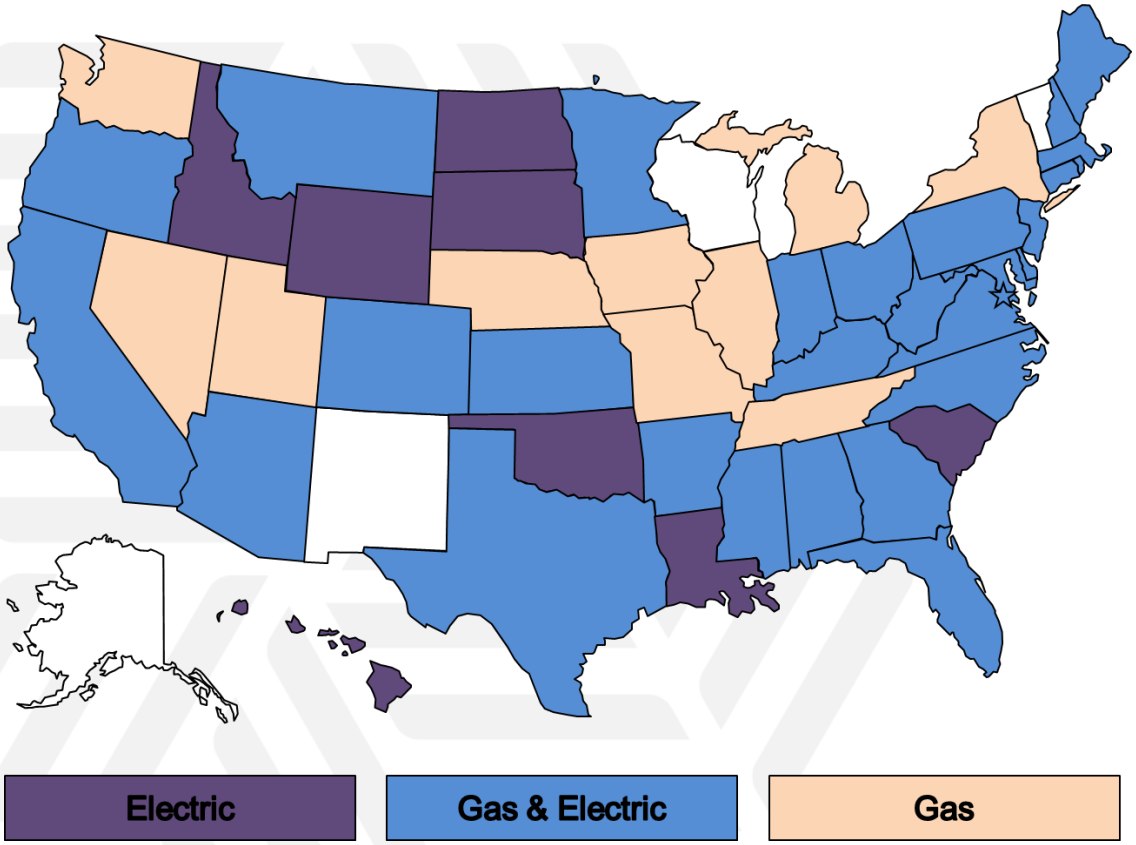
Electric Revenue Decoupling Precedents



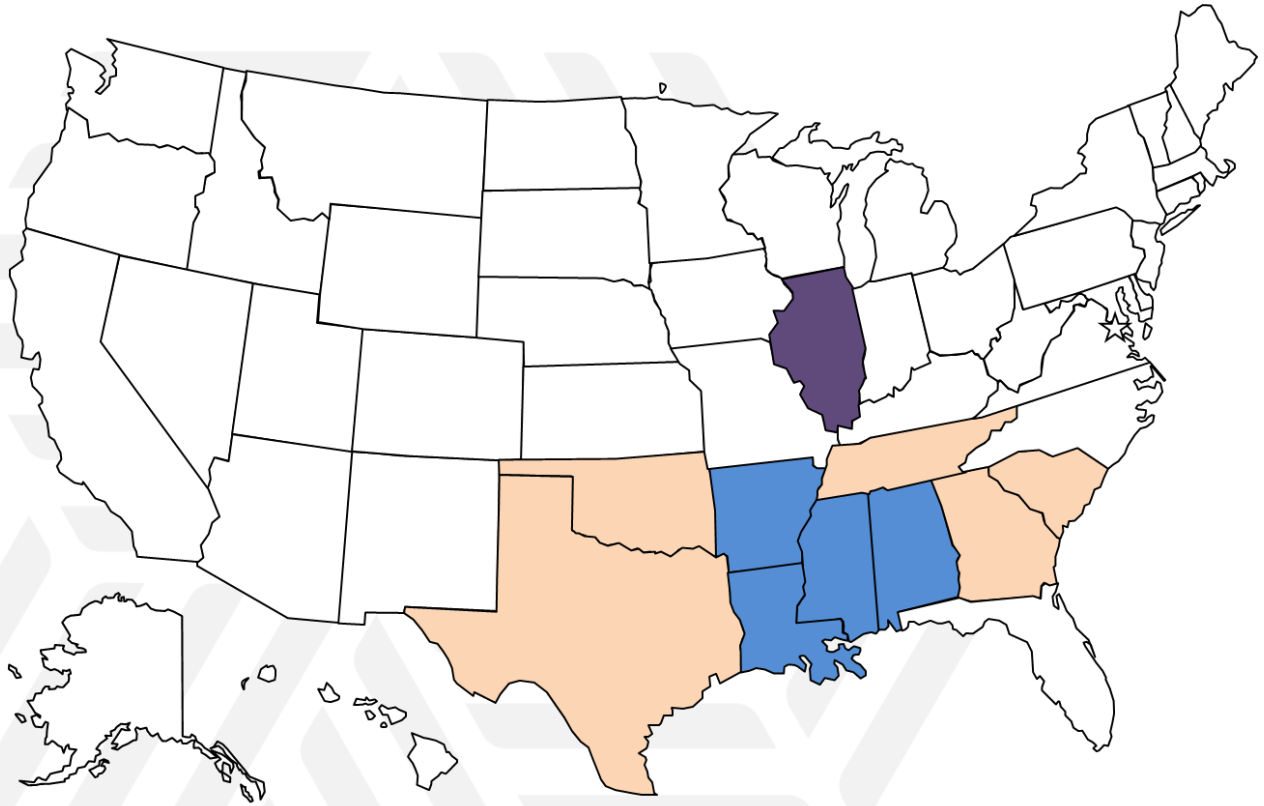
Capital Cost Tracker Precedents



Cost trackers are a common way to finance capex surges

Trackers in a few states track substantially *all* distribution capex

Retail Formula Rate Plan Precedents



Formula rates fund grid modernization in IL

Marketing Flexibility

- MRPs can afford utilities more marketing flexibility by reducing rate case frequency and opportunities for cross-subsidization

  e.g., "Streamlined regulation" of optional tariffs and services

  - Special contracts
  - Green power packages (utility scale and distributed)
  - Energy transformation services (e.g., EV charging, heat pump leasing)
  - Reliability-differentiated services
  - Other smart-grid-enabled services

- MRPs have been popular in utility industries facing competition, technical change, and complex, changing demand

Productivity Trends of New England Power Distributors (2007-2016)

Company	Capital	O&M	Multi-Factor
Green Mountain Power	0.46%	4.72%	2.27%
NSTAR Electric	1.64%	2.71%	2.10%
Western Massachusetts Electric	0.61%	0.47%	0.50%
Narragansett Electric	1.08%	-0.45%	0.34%
Central Maine Power	0.99%	0.11%	0.24%
Fitchburg Gas and Electric Light	-0.03%	-0.76%	-0.31%
Connecticut Light & Power	-0.32%	0.13%	-0.33%
United Illuminating	-3.96%	-0.02%	-1.97%
Massachusetts Electric	-1.78%	-4.13%	-3.01%

Suggestions for Further Reading

California Public Utilities Commission (2016), *Decision Addressing Competitive Solicitation Framework and Utility Regulatory Incentive Pilot*, R-14-10-003, December. http://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=171555623

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Mark Newton Lowry, Matt Makos and Kaja Rebane (2016), *Performance Metrics and PBR for US Electric Utilities*, prepared for Edison Electric Institute and a consortium of US electric utilities.

Suggestions for Further Reading (continued)

Mark Newton Lowry and Tim Woolf (2016), *Performance-Based Regulation in a High Distributed Energy Resources Future,* prepared for Lawrence Berkeley National Laboratory. https://emp.lbl.gov/sites/all/files/lbnl-1004130_0.pdf

Mark Newton Lowry, Matthew Makos, and Jeff Deason (2017), *State Performance-Based Regulation Using Multiyear Rate Plans for U.S. Electric Utilities,* prepared for Lawrence Berkeley National Laboratory. https://eta.lbl.gov/sites/default/files/publications/multiyear_rate_plan_gmlc_1.4.29_final_report071217.pdf

New York Public Service Commission (2017), *Order Approving Shareholder Incentives*, New York Public Service Commission Case 15-E-0229.

New York Public Service Commission (2017), *Order Extending Brooklyn/Queens Demand Management Program*, New York Public Service Commission Case 14-E-0302.

Ontario Energy Board (2016), *Handbook for Utility Rate Applications.*

Mark Newton Lowry

President, Pacific Economics Group Research LLC (PEG)

- Active in PBR since 1990s
- Specialties: multi-year rate plans, productivity and benchmarking research, revenue decoupling
- Recent clients: Alberta Utilities Consumer Advocate, Association Quebecoise des Consommateurs d'Electricite Industriels, Commercial Energy Consumers of British Columbia, Edison Electric Institute, Green Mountain Power, Ontario Energy Board, Berkeley Lab, Xcel Energy
- Former Penn State University energy economics professor
- PhD Applied Economics, University of Wisconsin
- Ohio native, Wisconsin resident

Speaker Contact Information

Mark Newton Lowry, PhD

President

Pacific Economics Group (PEG) LLC

www.pacificeconomicsgroup.com

44 East Mifflin St., Suite 601, Madison, WI

608-257-1522 ext. 23

mnlowry@pacificeconomicsgroup.com